Automated Identification and Characterization of Landforms on Mars

PI: Tomasz Stepinski, USRI/LPI

We propose development, implementation, testing, and application of novel methods for automated identification and analysis of selected landforms on Mars. Because of the large and increasing volume of of Martian data such automated techniques are essential for thorough data analysis. In particular, we will will implement algorithms for an identification and characterization of Martian impact craters and valley valley networks. In a major break with the past attempts to automate identification of landforms on planetary surface, the proposed algorithms are based on digital elevation data instead of imagery data. Using a fusion of methods from the fields of digital terrain analysis, data mining, and computer vision, we will produce production grade, fully autonomous algorithms. The crater identification algorithm will be used to construct a catalog of Martian craters that, in addition to craters coordinates, lists all their physical parameters. Such catalog would be an invaluable resource for a range of Martian studies. The valley networks mapping algorithm will be used to map drainage systems and to produce continuous maps of drainage density. These are important resources in the studies of past Martian climate. The proposal offers proof-of-concept results for these two algorithms. In addition, we propose to improve on on our recently developed method for a general, unsupervised landform classifier, which subdivides Martian landscape into constituent landforms. We will employ the technique of semi-supervised clustering to increase the accuracy of the original classifier. We expect that the new classifier will provide, among other benefits, an alternative method for crater identification and analysis. The methods developed in the proposed research are applicable to other bodies in the Solar System, such as the Earth, the Moon, and Mercury, for which the topography data is available, or is about to become available. By automating analysis of some of the most interesting landforms on Mars, the proposed research increases efficiency of the Science Mission Directorate research, which is one of the goals of the AISRP. It is highly relevant to the NASA objective of thorough study of planet Mars.

Integration of Orbital, Descent and Ground Imagery for Topographic Capability Analysis in Mars Landed Missions

PI: Rongxing Li, Ohio State U

The goal of the proposed research is to develop advanced geo-information technology to integrate orbital, descent, and ground imagery for topographic capability analysis in Mars landed missions. Objectives of the project are to: (1) Investigate how to integrate the orbital, descent and ground imagery within a true 3D integrated geometric model, (2) Estimate the precision of topographic features mapped on the Martian surface, and (3) Develop innovative applied information methods to register orbital, descent and ground imagery through distinctive landmarks, and to develop methods for automatic mapping of large terrain features such as major craters, hollows, and hills. Systematic assessment of topographic mapping capabilities of orbital, descent and ground imagery will be conducted based on photogrammetric bundle adjustment and statistical analysis. The current bundle-adjustment technology, which has been used during MER (Mars Exploration Rover) mission operations for MER landing-site mapping and rover localization using ground images, will be extended to include orbital and descent images within an integrated geometric model. Using an extended bundle adjustment, the positions and orientations of all three types of images will be adjusted in this integrated image network to achieve the best possible accuracy. Topographic products, such as digital terrain models (DTMs), orthophotos, and 3D dynamic models (VRML), will be generated after bundle adjustment of the image network. These products are very important for topographic and geological characterization of landing sites, for crater mechanics modeling, and for other scientific research in future Mars landed missions. The data to be used to verify the developed technology include MOC NA imagery (cPROTO, 0.5-m resolution), Mars Express HRSC stereo imagery (10-m resolution), MOLA original profiles and DTMs (Digital Terrain Models), descent (DIMES) images, and MER Pancam and Navcam stereo images taken at the two landing sites of the MER mission. The proposed research goes beyond existing efforts because it integrates orbital, descent and ground imagery in a new comprehensive geometric model and facilitates high-precision topographic mapping. The developed methods can be used in future missions for regional regional topographic mapping to support landing-site selection, for topographic characterization before landing, and for mission planning and surface operations at an extended landing site.

Intelligent Sensor Network Study of Dust Devils

PI: Ralph Lorenz, U of Arizona

We propose to perform a novel field study of terrestrial dust devils in Arizona using initially an array, evolving into an intelligent network, of smart sensor platforms. Dust devils are a dynamic feature of the Martian environment, playing an important part in climate via dust loading, and can significantly affect surface operations by sweeping dust off solar panels as well as possible electrostatic discharge effects. Even on Earth, dust devils are implicated in ~100 light aviation accidents in the last 15 years and thus can be considered a genuine hazard. A systematic study, which without the application of intelligent systems would be a labor-intensive effort, is therefore suggested. An array of rapid-sampling sensor platforms can generate datasets on the formation, structure and evolution of dust devils that can be compared with mesoscale numerical models. After initial data acquisition, algorithms will be developed by which the field network can autonomously identify the presence of dust devils and generate reports. Intelligent sensing yields orders of magnitude reduction in data volume.

Adaptive Algorithms For Optimal Classification and Compression of Hyperspectral Images

PI: Tamal Bose, Utah State U

Hyperspectral images are obtained from large focal plane spectrometers with an array of multiple sensors that are arranged in an NxN matrix. Each sensor yields an Mx1 spectrum, where M is the number of image bands, typically between several dozens to several hundreds. Spectral and hyperspectral images are used today in most space science and earth science missions because of the richness of information they capture about the compositional properties of surface materials. Since hyperspectral images constitute very large data sets, they need to be compressed for storage and transmission. Classification of spectral species is the primary task in the analysis of hyperspectral imagery, with the goal of distinguishing as many species as possible, as accurately as possible. Therefore, a measure of good compression should be based on how well it preserves class distinctions. This, in general, does not correspond to a minimum distortion measure. The goal of this project is "classification-driven compression" of hyperspectral images. That is, we propose to design and implement compression algorithms that will be optimized for efficient classification. The compression algorithms will be recursively optimized as a function of certain classification (or unsupervised clustering) metrics. Performance metrics will be defined for the classification schemes and some others for the compression algorithms. A combination of these metrics will be used to design a cost function, which in turn will be optimized to update the compression algorithms. In other words, the performance of the classification algorithms will dictate the real-time adaptation of the digital filters used in the compression schemes. This is a new concept, where the filters in the compression algorithms, instead of of acting independently, form a closed loop coupled system with the classification (or clustering) algorithms. The algorithms will be designed for real-time on-board processing. Therefore, we seek to develop fast filtering algorithms with the lowest possible computational complexity. This work will change the way we look at and understand hyperspectral data. Since we will measure the quality of the compression by the retention capability of the distinction among spectral species, for any required compression ratio, we will much more successfully preserve the meaning of the data inherent in and specific to spectral images, than distortion based compressions. The proposed work was inspired by and and will build on the results of two previous AISRP grant projects. All space science missions that carry carry spectral imagers can significantly benefit from the results of this project in scenarios where lossy data compression is needed at compression ratios as high as can be achieved without loss of relevant spectral information. Because of our approach to compression, we will be able to determine the optimal compression ratio in an adaptive manner. The fast parallel implementation of the compression and classification algorithms, makes the combined system described in this proposal an intelligent, real-time on-board data understanding, compression and classification machine that learns on-chip and adapts continuously to new circumstances as desired, modifying the compression scheme to best suit a given environment.

A neural map view of planetary spectral images for precision data data mining and rapid resource identifi

PI: Erzsebet Merenyi, Rice University

This project follows up on a current three-year AISRP grant, NAG5-10432, which will end 8/2004. It addresses a pressing need for rapid yet intelligent analysis of voluminous multi- and hyperspectral images in order to extract key data and generate knowledge. Spectral imaging plays a leading role in remote identification of surface materials of Earth (Landsat, AVIRIS, Hyperion), Mars (Pathfinder, MGS, MER), the Jovian system (Galileo NIMS), the Saturnian system (Cassini VIMS) and other solar system bodies. Hyperspectral sensors, in particular, enable detailed identification through the complexity complexity of signatures measured in hundreds of narrow spectral bands. The challenge in automated and fast (real time, on-board) interpretation of these huge images calls for massively par-allel algorithms, as well as it requires sophisticated algorithms for optimal knowledge extraction. Properly utilized, Artificial Neural Networks (ANNs) can provide both. The current project engineered ANNs, specifically Self-Organizing Maps (SOMs) and their hybrids for efficient and sophisticated clustering and classification of spectral images, developing custom modules supported by commercially available components. Based on some of the latest theoretical research on SOMs, the tools we developed, jointly with European experts, are powerful for distinguishing a large number of spectral classes and for the discovery of "interesting" but uncommon and spatially very small classes. We use information theoretically principled SOM approaches, which increases power and confidence in autonomous data mining. We demonstrated the effectiveness and high quality of data analysis on sample IMP spectral images, Cassini VIMS Jupiter fly-by im-agery, AVIRIS and other data representing typical challenges in in NASAís missions. We propose to advance these computational intelligence capabilities in three ways: 1) We will add significantly new theoretical strength to information extraction modules. 2) The software, HYPEREYE, will be made transferable to other users through high-level graphic interface, augmented software design, tutorials and wrapping, opening an important phase of technology infusion that will take recent and future developments into the user community. 3) We will directly participate, using our methods and software, in analyses of spectral images forthcoming from the Mars Exploration Rovers and Cas-sini VIMS Saturn orbital tour, and (pending its funding) a Pluto/icy satellites spectral analysis project. The ëneuralí core of our software is already suitable for implementation in high-speed massively parallel hardware (which could be an on-board analysis capability), as it was one of the original objectives of our work. We are pursuing that line of development outside of this project proposal and, if successful, we anticipate using the hardware to support this work as well.

Application of Machine Learning Technology to Martian Geology

PI: Ruye Wang, Harvey Mudd College

New and more powerful machine learning technologies have always been sought to effectively analyze multi/hyperspectral remote sensing data, which have been rapidly accumulating by the ever-increasing number of spacecrafts launched by NASA. In particular, algorithms for more sensitive detection and accurate classification are necessary to help identify, map, and characterize materials with subtle spectral differences such as a diverse suite of rock types that may exist on the surface of Earth or other planets such as Mars. With ever-increasing data from ongoing and near-term missions, such tested and proven techniques will greatly benefit the planetary community, as traditional means of data analysis may not produce the required sensitivities for remote detection and accurate classification of various surface materials. We propose to develop and test an intelligent system composed of a suite of the latest cutting-edge algorithms for the detection and classification of surface materials of weak and/or similar spectral signatures that are otherwise difficult to detect and distinguish by the existing conventional methods. The algorithms include, for example, the kernel-based methods, such as support vector machines (SVMs), which have demonstrated their superiority over many conventional classifiers in terms of classification accuracy and the independent component analysis (ICA) methods, which is capable of unmixing the observed signals to find the independent components with minimum prior knowledge and additional information, and is therefore a powerful tool to separate mixed materials contained in remote sensing image data. While such methods have already found applications in different scientific fields, here we propose to develop an intelligent system by coupling new methods and algorithms with the strength of these methods for the purpose of addressing a variety of space science related problems. In particular, we will use the system to more accurately assess the rock types in the ancient mountain ranges of Mars, Thaumasia highlands and Coprates rise, which includes determining whether the ranges consist of more silicic-rich, mountain building rock. The identification of such a suite of rocks would ultimately lead to an improved understanding of the geological evolution of early Mars.

Advanced Visualization in Solar System Exploration and Research (ADVISER)

PI: James Head, Brown University

We propose 1) to advance space science knowledge, exploration capabilities, and teaching and outreach, outreach, and 2) to research advanced visualization tools for space science and education, through ADVISER (Advanced Visualization in Solar System Exploration and Research), a problem solving environment (PSE) for planetary geosciences that will integrate and extend the state-of-the-art in hardware and software technologies. Our three-pronged science approach (Mars polar evolution, tropical glaciers, and the Noachian hydrological cycle) builds on our central strengths in planetary geoscience, as well as supporting NASA Goals and Objectives and the basic NASA research and exploration theme for Mars "Follow the Water", and thus will provide scientifically credible direction for tool research and scientific discovery. Geologists explore the Earth primarily through field work and and analysis of the geological record at various points on the surface, integrating these individual points of understanding using more synoptic analysis. Planetary geoscientists commonly work in the reverse order, starting from synoptic and orbital data and working back down toward the surface. New developments in advanced visualization, and immersive virtual reality environments have created the ability to place the geoscientist back down on and near the surface of the planet and to regain the perspective that is the foundation for the understanding of relationships necessary to unlock the history of the planets. ADVISER is a set of tools that provide the planetary geoscientist with the capability to operate and analyze data as if they were on or near the surface of a planet. The ADVISER PSE has four basic parts: 1) Geoscientist on the Surface: Visualization capabilities that enable the placement of the geoscientist into the surface environment through immersive virtual reality (IVR) and related desktop capabilities using topographic data and surface rendering programs. 2) Importation and Visualization of of Multiple Data Sets: On-demand importation, co-registration and overlay of relevant image format data sets to enhance the ability of the geoscientist to correlate and interpret data for scientific analysis. 3) 3) Field Kit Development: A menu that has the capabilities commonly carried out by the geologist in the the field using things like the Brunton compass, altimeter, etc. 4) Ancillary Virtual Field Instrument Development: a) Virtual Photography: Permits documentation of individual images or video streams. b) b) Virtual GPS: Permits exact location at any point in the analysis and tracking and storage of traverses. c) PDA: Equivalent of the field notebook and permits the investigator to record a host of information for synthesis and publication. Together, these products will contribute significantly to both the scientific and pedagogical goals of the AISR program.

Analyzing Science Operations for the Search for Life as part of a Multi-Year Robotic Campaign to Exp
PI: Geb Thomas, University of Iowa

In the austral spring (September-October) of both 2004 and 2005, a multi-institutional, multi-national effort led by Carnegie Mellon University will conduct long-duration robotic explorations of the Atacama Atacama Desert in Chile to develop technologies and methods for upcoming NASA missions that will search for evidence of past life on Mars. The project proposed herein will leverage this large-scale effort to measure and improve the effectiveness of robotic science operations. This research will extend current analysis of rover-mediated geology to rover-mediated habitat characterization. The work will continue to emphasize the effects of different data collection and display techniques on the science teamís conclusions. The principal hypothesis this research is that the quality and reliability of scientific conclusions regarding past or present life in arid environments is dependent on the type of evidence collected by the rover, the scientistsí data analysis techniques, the processes used by the scientistsí to form and share hypotheses and conclusions, and the science operations software. The principal objectives of this research, each specifically associated with AISR program objectives, are to: 1) reduce mission development time by analyzing how scientists characterize a habitat, 2) reduce mission development risk by identifying mission-critical and problematic analysis tasks, 3) increase science return from the data by analyzing long-traverse science collection strategies, and 4) increase data return by refining the science interface to improve analysis effectiveness. The proposed research will analyze the processes used by astrobiologists and geologists when searching for signs of life in a Mars-like environment. Our previous and ongoing work with robotic geology has successfully characterized limitations in scientific interpretations caused by rover sensors, differences in scientists' interpretations, and limitations of the science interface. These limitations were identified and studied using perceptual experiments in which scientists analyzed sample images and physical specimens. In addition, transcripts transcripts of scientists participating in a simulated rover field experiments have been examined to further understand these limitations. The proposed project will quantify analyst and instrument limitations that could affect the success of future missions in the search for life on Mars and will develop develop mitigating strategies to avoid inappropriate conclusions regarding the presence of life on Mars.

Neural Net Spectral Analysis of Icy Volatiles in the Solar System

PI: Eliot Young, Southwest Research Institute

We will train and apply a two-stage neural net algorithm to spectra of satellites (Rhea, Mimas, Dione, Europa, Ganymede, Callisto, Titania, Umbriel, Ariel, Oberon, Miranda, Triton and Charon), Centaurs (Chariklo and others) and Pluto all of which have surface water ice or methane ice. These two ices have have IR spectral features that are diagnostic of composition, grain size, surface temperature and crystalline state, but the interpretation typically depends on subtle spectral features that defy many spectral classification schemes. The proven neural net algorithm we will use has a self organizing map as a preprocessor to help robustly extract spectral information. This two-tier neural net has already achieved excellent results in several diverse palentary applications.

A Numerical Simulation Tool for Planetary Subsurface Radar

PI: Steven Cummer, Duke University

Exciting recent discoveries in planetary science have made subsurface exploration instruments one of the top priorities on future planetary science missions. Remote sensing techniques, specifically ground penetrating radar (GPR), could be very effective in the critically important search for water. GPR instruments are planned on many planetary missions in the coming decade. But there are many challenges to successfully operating planetary GPR instruments and interpreting the data. These challenges create a compelling need for meaningful quantitative analysis of environmental impacts on instrument operation and of GPR data interpretation. We propose to develop an accurate and general numerical modeling tool to simulate the planetary GPR problem. This tool would have substantial value value to the planetary science community as a means for realistic numerical experimentation of an environment completely unavailable for actual field experiments. This code would find immediate use in quantifying the capabilities of planned GPR instruments in light of major environmental unknowns, and providing realistic signals on which data processing schemes can be tested. In the future use, the proposed model would be valuable in bounding the interpretation of any data returned from these instruments. The code development addresses a compelling need in the planetary science community and is targeted directly at AISR program goals.

Adaptation & Use of OpenGIS Web Technologies for Multi-Disciplinary Access To Planetary Data

PI: Elaine Dobinson, Jet Propulsion Laboratory

We propose to adapt the OpenGIS standards and technologies for the access, processing, and display of Earth geospatial data to the lunar and planetary domains. In particular, we will implement prototype WMS and WCS servers to present high level data products derived from the Mars and lunar datasets archived within the Planetary Data System (PDS). The specific information technologies used for this work are the rapidly developing and well-supported OpenGIS methodologies for Earth data. We will extend and generalize these standards for terrestrial planetary bodies, using Mars and the Moon as both subject of the prototype implementations and the exemplar for standards extensions. GIS software is being increasingly used by the planetary, and, in particular, the planetary geologic mapping communities. To our knowledge, however, this would be the first concerted effort to build a general data data delivery service that would feed and augment the use of GIS commercial software for data processing and analysis. The basic motivation is that, while the World Wide Web has brought a revolution to the PDS in terms of ease of access, the accessible products remain relatively low level. Planetary and lunar investigators will benefit from a unified methodology for accessing higher-level products that serve as substrate, background, and currently known detail pertinent to their ongoing work. work. The thrust of this effort is to capitalize on a large body of existing technology and bring it to bear for the benefit of the planetary community. To be successful we will need to determine the minimum changes to that existing technology needed for the adaptation process. The central challenge is is to craft a coherent set of changes that are comprehensive enough to apply to planetary bodies in general, while circumscribed enough to keep the work within the prescribed scope. This work directly pursues a major objective of the AISR call: ìIncrease science or educational return from the data through, for example, advanced knowledge discovery, data synthesis and data presentation methodologies.î Since we anticipate our results will have the most impact relative to the study of the Moon and the terrestrial planets, we connect most directly to the following NASA Goals, Science Objectives, and Research Focus Areas: Goal II, Solar System Exploration Theme, RFA 1(c); Goal II, Solar System Exploration Theme, RFA 4(c); and, Goal II, Solar System Exploration Theme, RFA 6(a). The nature of our work will lead to the broad publication of global multi-phenomenological maps of lunar and planetary bodies. These maps will be hierarchical and afford both synoptic and high-resolution views of each body published. The multiple views will make clear what differences exist, and, because they present the different phenomena as a composite, this capability should provide a a basis to better understand planetary processes. We have assembled a highly expert and broadly based team for these tasks. With balance in both Information Technology and Planetary Science, we bring many years of direct experience with the PDS and with the scientific mapping of planetary bodies. Most Most pertinently, we have successfully brought OGC specification and technology to the management and publication of massive geospatial datasets.

Multi-Scale Atmospheric Numerical Modeling and Data Assimilation for Planetary Applications - With a Focus on Mars

PI: Mark Richardson, California Institute of Technology

The goal of this proposal is the development of the first flexible, multi-scale numerical, dynamical model of planetary atmospheres - and specifically the Martian atmosphere. The model will provide a single tool for study of atmospheric motions on scales from the micro (tens to hundreds of meters) to global; it will provide full flexibility in spatial grid construction; and will provide a framework for Martian data assimilation and weather prediction. The project will take advantage of the new Weather Research and Forecast (WRF) modeling system developed by a consortium of US universities and government organizations - NCAR, NOAA and the DoD - and will thus track (and in some key areas lead) the state-of-the-art in terrestrial model design. This project will see the infusion of a number of modern software coding practices into planetary/Martian atmospheric modeling, including extensive modularity, from-the-ground-up use of fast and compact Fortran 90/95, and explicit MPI parallelization. Support is requested to allow conversion of this community model to allow for generalized planetary use (and for Martian conditions in particular) and to undertake changes in the dynamical core to allow it to run as a global model. By leveraging substantial investment in model development by other agencies, agencies, this effort will provide a very high return for NASA investment ñ as well as benefiting those other agencies. We intend to feed the model improvements from this project back into the public-domain WRF system, making it available for all NASA planetary and Earth systems science researchers.

Data-Centric Analysis of Science Return for Human-Directed Robotic Geology
PI: Geb Thomas, University of Iowa

In the austral spring (September-October) of both 2004 and 2005, a multi-institutional, multi-national effort led by Carnegie Mellon University will conduct long-duration robotic explorations of the Atacama Atacama Desert in Chile to develop technologies and methods for upcoming NASA missions that will search for evidence of past life on Mars. The project proposed herein will leverage this large-scale effort effort to measure and improve the effectiveness of robotic science operations. This research will extend current analysis of rover-mediated geology to rover-mediated habitat characterization. The work will continue to emphasize the effects of different data collection and display techniques on the science teamï¿½s conclusions. The principal hypothesis this research is that the quality and reliability of scientific conclusions regarding past or present life in arid environments is dependent on the type of evidence collected by the rover, the scientistsï¿½ data analysis techniques, the processes used by the scientistsï¿½ to form and share hypotheses and conclusions, and the science operations software. The principal objectives of this research, each specifically associated with AISR program objectives, are to: 1) reduce mission development time by analyzing how scientists characterize a habitat, 2) reduce mission development risk by identifying mission-critical and problematic analysis tasks, 3) increase science return from the data by analyzing long-traverse science collection strategies, and 4) increase data data return by refining the science interface to improve analysis effectiveness. The proposed research will analyze the processes used by astrobiologists and geologists when searching for signs of life in a Mars-like environment. Our previous and ongoing work with robotic geology has successfully characterized limitations in scientific interpretations caused by rover sensors, differences in scientists' interpretations, and limitations of the science interface. These limitations were identified and studied using perceptual experiments in which scientists analyzed sample images and physical specimens. In addition, transcripts of scientists participating in a simulated rover field experiments have been examined to further understand these limitations. The proposed project will quantify analyst and instrument limitations that could affect the success of future missions in the search for life on Mars and will develop mitigating strategies to avoid inappropriate conclusions regarding the presence of life on Mars.

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Autonomous Mineral Detectors for Mars Rovers and Landers
PI: Martha S. Gilmore, Wesleyan University

We will design software that will provide instrumented rovers the ability to select and analyze spectroscopic data, characterize a landing site and test geological hypotheses autonomously. Our approach is to combine supervised methods for focused mineral detection and broader mineral classification with an unsupervised clusterer that identified unusual or previously unencountered mineral mineral classes. We will 1) improve our current carbonate detector by validating its sensitivity and performing more detailed modeling of nonlinear mixture behavior observed in intimate mineral mixtures, 2) identify other mineral classes of interest, particularly those known to exist on Mars and be indicators of life on Earth, and design detectors for those minerals, and 3) develop a "novelty detector" that can identify new minerals in a series of observations. The algorithms will be trained using synthetic synthetic data from spectral libraries and tested in real data collected in the field.

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Improving Swift

PI: Harold Levison, Southwest Research Institute

Understanding the formation of planets is one of the most fundamental problems facing astronomy today. It is also an area of great current interest since NASA has determined that understanding the origin and evolution of our solar system and planetary systems around other stars is one of its fundamental scientific goals. Perhaps the best method for understanding how the solar system formed is is by performing large-scale numerical experiments. Such simulations require computer codes that can integrate the orbits of a large number of bodies for, in many cases, timescales approaching the age of the the solar system. Over the last 10 years, PI Levison and CoI Duncan have developed a software package, known as Swift, capable of performing these types of simulations. Swift quickly became an industry standard for the planetary community, and is used all over the world. Here we propose to make make several fundamental improvements to Swift that would significantly enhance its utility to the planetary community. We plan to: (1) employ more sophisticated methods for calculation the forces between objects, (2) parallelize parts of the code to take advantage of the current popularity of Beowulf clusters, and (3) rewrite the code and thereby utilize more efficient data structures.

Capturing Planetary Science Data from NASA Supported Research

PI: Mark V. Sykes, University of Arizona

A robust web interface will be built, creating the capability for hundreds of NASA PIs to submit planetary data and ancillary files to the NASA Planetary Data System, an archive which currently focuses on the ingestion of large flight project databases. This interface will be transparent, requiring no knowledge of PDS specifics by the submitter. Utilizing information from the submitter, it will generate all necessary PDS internal files and formats which in turn will be automatically run through currently existing PDS standards validation software. The interface design will take advantage of common data structures across science enterprises and take advantage of the platform independence of the World Wide Web and increasing transfer rates of the Internet. This interface will allow for the rapid availability availability of a large amount of diverse data generated by OSS research programs, allowing for greatly increased scientific return from those programs. Prototype and final interface designs and pipelines will be reviewed by non-PDS researchers and PDS scientists and data engineers to ensure usability, efficiency, and reliability before final delivery to the PDS. The PDS Small Bodies Discipline Node (managed by the Co-I, Dr. Michael F. A'Hearn) has committed to testbedding this interface as a precursor to broader implementation across all relevant PDS Discipline Nodes. Because most of these data structures are also common to astrophysics data sets, this will also have applicability to astrophysics astrophysics data archives.